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NOTES ON THE MEADOW JUMPING MOUSE
(ZAPUS HUDSONIUS) ESPECIALLY RE-
GARDING HIBERNATION

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THE jumping mouse is the only one of the wild mice of this region (Massachusetts) which exhibits the habit of regular hibernation. Regarding this habit there are a number of references in the literature on the subject. Barton¹ was one of the first to refer to the fact that this mouse became dormant in winter. He says, in describing the actions of one he had in captivity:

On or about the 22d of November it passed into the torpid state. It is curious to observe that at the time it became torpid the weather was unusually mild for the season of the year, and moreover the animal was kept in a warm room, in which there was a large fire the greater part of the day and night . . . It was frequently most active while the weather was extremely cold in December.

This was in Philadelphia, Pa.

Audubon and Bachman² regret that they live in a region where the species does not exist and can not speak from personal observation on the subject.

Godman,³ Thompson⁴ and Kennicott⁵ speak of its habit of hibernation.

Tenney⁶ gives an account of a specimen of this species taken alive on January 18, 1872, near Vincennes, Ind. It was dormant, coiled up tightly, "the nose being placed upon the belly, and the long tail coiled around the ball-like

¹ "Some Account of an American Species of Dipus or Jerboa," by Benjamin Smith Barton, M.D., *Translations of the Am. Philosophical Society*, Vol. IV, No. XII, 1799.

² *Viviparous Quadrupeds of No. America*, Vol. II, 1851, p. 255.

³ Godman, "Am. Nat. Hist.," Vol. I, 1842.

⁴ Rev. Zadoc Thompson, "Nat. and Civil Hist. of Vermont," 1842.

⁵ Kennicott, Patent Office Report for 1857.

⁶ Tenney, "Hibernation of the Jumping Mouse," *AM. NATURALIST*, June, 1872, Vol. VI, No. 6, pp. 330-332.

form which the animal had assumed." It was taken from a nest about two feet below the surface, made of bits of grass. The mouse showed no signs of life at first, but on being held in his hand, soon became feebly active, and on being placed in a warm room, came out of its dormant condition entirely. It again became dormant that night, but was aroused twice again by the application of heat, within the next few weeks, in spite of very cold weather.

Merriam⁷ tells of taking an active male at Easthampton, Mass., on February 11, 1872, and states that during the mild winter of 1881-82, in Lewis County, Northern New York, he saw jumping mice active several times.

Seton⁸ speaks of finding a *Zapus Hudsonius* on September 27, 1888, at Carberry, Manitoba, in a nest of leaves under the roots of a stump, nearly torpid. He says:

In the country near Carberry, I never saw it active after September first.

Stone and Cram⁹ believe that this mouse passes six months or more of every year hibernating underground. They speak of seeing a family of them turned up by a plough in May and exhibiting not the slightest symptom of life, on being handled or breathed upon.

Burroughs¹⁰ tells of a female jumping mouse in captivity that began hibernating early in November and continued until May, with several intervals of activity, especially after warm weather came on.

Preble¹¹ says:

Hibernation varies with the locality, but usually begins about the time of the first heavy frosts and lasts until Spring. The fall pelage is usually assumed and the animals become exceedingly fat before entering winter quarters. Although they often lay up stores of food in nests or burrows during summer, it is not known that they use this food during winter. The animals are generally found singly (sometimes in pairs) in nests at a depth varying from a few inches to two or three feet below the surface. Hibernation sometimes takes place above ground.

⁷ C. H. Merriam, M.D., "Mammals of the Adirondack Region," 1884.

⁸ E. T. Seton, "Life-histories of Northern Animals," Vol. I.

⁹ Stone and Cram, "American Animals," p. 103-104.

¹⁰ John Burroughs, "Squirrels and Other Fur Bearers," pp. 121-124.

¹¹ E. A. Preble, "Revision of the Jumping Mice of the Genus *Zapus*," U. S. Dept. Agr. N. A. Fauna Series, No. 15, 1899.

On June 25, 1912, a female *Zapus Hudsonius* was taken alive, by the writer, on the edge of a small pond in eastern Massachusetts. It was placed in a small wire cage, and after a few frenzied efforts to escape, became quite tame.

On July 5 it gave birth to five young, blind and hairless; but when the family was transferred to a larger cage, the mouse deserted the young and they soon died. One disappeared mysteriously, and may have been eaten by the mother. The young measured at birth: total length 33 mm.; tail 9 mm.; hind foot 4 mm.

Throughout the summer the mouse ate chiefly rolled oats and shredded wheat, and was also very fond of strawberries and blueberries. It refused most of the common fruits and vegetables.

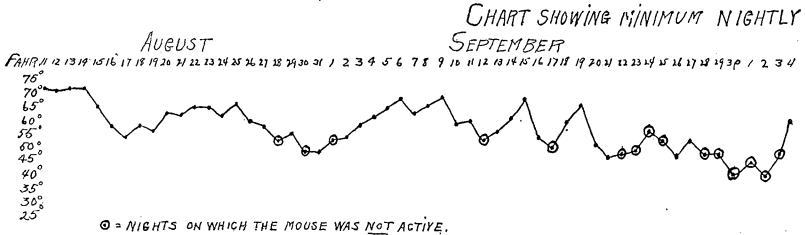
It was almost wholly nocturnal in its activity, although when disturbed during the day it would immediately begin to eat and remain active for half an hour or more. Toward the latter part of the summer, it seemed to grow quite fat. Rhoads¹² says in this connection:

When going into winter quarters they are exceedingly fat, as I can testify from experience in removing this tenacious yellow blanket from the skins of them. This fat is their fuel. By spring it is nearly gone.

During the latter part of August there were several very cool nights (49° F. minimum) and on the night of August 28 it did not come out. This fact was apparent from the clean drinking dish, which was placed in such a position that the mouse could not approach without scattering saw-dust in it. The absence was repeated on August 30, and September 1. Throughout September its actions were irregular. Every night until the 21st, with the exception of the 12th and 17th, it was active, but on the 22d disappeared for four nights. It was then active for two more nights (26 and 27) and following that, inactive for six (September 28 to October 3). From October 4 to 28 it was out every night, although not as vigorous as formerly, neither did it eat as much. When approached it seemed to pay no heed, as if in a sort of stupor.

¹² S. N. Rhoads, "The Mammals of Pennsylvania and New Jersey."

OFFICIAL OBSERVATIONS
FROM U. S. WEATHER BUREAU, BOSTON STATION.



There was no evidence of any attempt at storing away a supply of food, although there was ample opportunity. This habit of storing food is mentioned by Hornaday¹³ who says:

In the autumn it stores in the ground quantities of food for winter use, but despite this fact, under certain conditions, it becomes so thoroughly dormant in winter that it seems to be quite lifeless.

According to Seton,⁸

It is quite ready to respond at any time to any spell of unusually fine, unseasonable weather, even in the depths of winter, and it is probably for these arousing times, as much as for the spring time famine, that it lays up its abundant stores of food.

Preble¹¹ also mentions this habit, but Shufeldt¹⁴ denies it. He says, in speaking of the deer mouse (*Peromyscus Leucopus*):

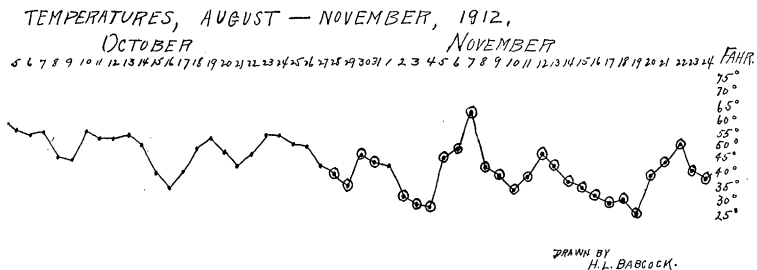
Is it to meet the requirements of his condition that this mouse lays up a goodly stock of food during the autumn? Something the *Zapus* does not do.

Following the period of activity through October, the mouse was inactive on the four nights of October 28, 29, 30 and 31, and reappeared for the last time on the night of November 1, after which it retired for the winter. The cage was placed by an open window of an empty box stall in a stable where the temperature was practically that of out doors. The mouse built its nest in the side of a large sod placed in one corner of the cage.

In spite of a very mild winter, the lowest official tem-

¹³ Hornaday, "The American Natural History."

¹⁴ R. W. Shufeldt, M.D., "Chapters on the Natural History of the United States."



perature for this section being only 3° F. (February 10, 1913,) the mouse did not survive the cold weather, and was found dead, when the cage was opened on June 17, 1913.

The nest was found to be located in the extreme end of the sod, only 1½ inches from the top and about 1 inch from the edge. It was roughly oval in shape, being hollowed out of the loam and lined with a few blades of grass. It measured roughly 1¾ inches by 1½ inches and was just large enough to contain the mouse when curled up into a ball. The opening was on the side. Death was probably caused from exposure to continued cold owing to the unprotected location of the nest.

The poor judgment shown in not building the nest securely in the middle of the large sod, and other similar instances of poor management, have led the writer to believe that the intelligence (if that term may be used) of the *Zapus Hudsonius* is of comparatively low grade, much lower, for instance, than that of the deer mouse (*Peromyscus Leucopus*).

The accompanying chart, which is a record of minimal nightly temperatures, according to the official observations of the U. S. Weather Bureau for this section (Boston), shows the activity of the mouse in relation to the temperature during August, September, October and November, and brings out some rather interesting facts. For example, on October 15, 16 and 17, with the minimum nightly temperature 42°, 36° and 42°, respectively, the mouse was active, while on September 22, 23, 24 and 25,

with the minimum nightly temperature of 48°, 49°, 56° and 53° F., respectively, a much warmer series of nights, it remained inactive. And again, after November 1, during a warm spell in which the minimum nightly temperature for November 7 was 64° F., the mouse did not appear.

A study of this chart suggests the question as to how much the temperature has to do with this habit of hibernation.

It is a somewhat general belief that temperature regulates the degree of torpidity.

Barton¹ maintains that

the torpid state of animals is altogether an accidental circumstance and by no means constitutes a specific character. The same species becomes torpid in one country and not in another. Nay, different individuals of the same species become torpid or continue awake in the same neighborhood or even on the same farm.

Seton⁸ believes that

while torpor is more or less controlled by temperature, the habit of torpidity, like the changing pelage of the white-hare, is so deeply ingrained constitutionally that there is a strong tendency to torpify at a given time without regard to the original cause.

It is evident from this chart that torpidity develops gradually, at first for only one night at a time. Whether this process is explained by a cerebral anemia, a slow toxemia of the brain centers or some other of the theories regarding sleep, it seems to require about two months in which to become sufficiently developed to control completely voluntary body functions. During that interval the animal occasionally awakens, probably from hunger and habit as much as from any effect in change of temperature.

After torpidity is thoroughly established, changes of temperature may be important external factors, as has been demonstrated on numerous occasions in producing a temporary activity by the application of heat. It is safe to say, however, that the temperature is not the only element which influences the length of the period of hibernation.